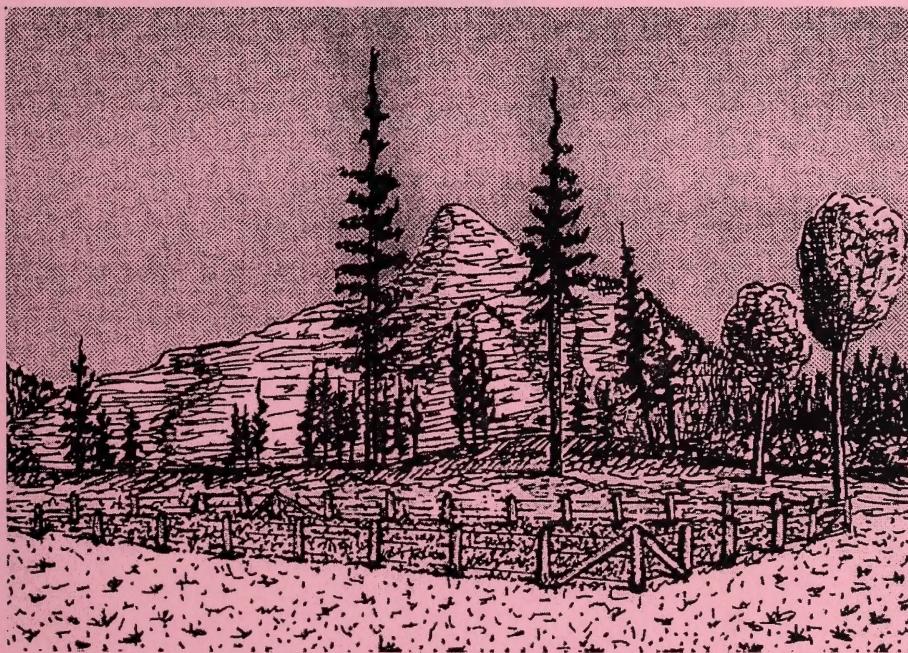


THE ROUGH FESCUE DOMINATED COMMUNITY
TYPES IN THE FOOTHILLS OF
NORTH-CENTRAL
ALBERTA



Alberta

ALBERTA SUSTAINABLE RESOURCE
DEVELOPMENT

THE ROUGH FESCUE DOMINATED COMMUNITY TYPES IN
THE FOOTHILLS OF NORTH-CENTRAL ALBERTA

Prepared by

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Table 1 gives a summary of the three and shrub/scrub flower dominated community types in Zone III.

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The rough fescue grassland community is a natural vegetation type that is not grazed by livestock and wildlife. This grassland is also important in maintaining the local biodiversity. Despite the importance of these grasslands, little understanding of their ecology. Willoughby (1993) and Willoughby (1997) have identified a Rangoon Fescue-Hairy willow, Rockrose-Lotus Thistle and Bog birch rough fescue-Beachberry dominated communities in the Upper Foothills and Subalpine subregions within the zone, but no attempt has been made at examining the relationships between these community types across the zone. In order to be able represent data from the rough fescue dominated communities north of 51° N latitude within the Upper Foothills, Subalpine and Mountain subregions were combined in order to determine diversity and to compare the structure of these types.

METHODS

All of the data from the rough fescue dominated grasslands identified by Willoughby (1993, Willoughby et al. (1997) in the Upper Foothills, Subalpine and Mountain subregions of Alberta were classified using both cluster analysis (CA) and ordination (PCO). The data included plant data over 2000 ha from the Hamber Flats, Forty Mile, The Cypress, Bow River Forest Land (or Zone), Rocky Flats, Purcell Corridor and Wilson

¹ Johnson (1969) and Hill (1980) felt that the third rough fescue zone was dominated by Northern rough fescue, but there appears to be extensive overlap between this species and Southern rough fescue, particularly in the southern part of the zone west of Rockies Mtn. House and Sundre.

ABSTRACT

The fescue grasslands of Alberta are an important grazing resource for both wildlife and domestic livestock. These grasslands are also found in some of the most ecological diverse areas of the province. Looman (1982) described three zones of rough fescue in Alberta, characterized by a different species. In the Northern rough fescue zone, north of 51° N latitude in the foothills of North-central Alberta three undisturbed rough fescue dominated types have been described. These include the Rough fescue-Hairy wildrye dominated community which is found on dry, well-drained sites. On moister sites with deep snow accumulation bog birch will invade to form the Bog birch/Rough fescue/Bearberry dominated community type. In contrast, on moist, rich sites tufted hairgrass co-dominates with rough fescue to form the Rough fescue-Tufted hairgrass dominated community type. This paper will describe and examine the successional relationships of these community types in the presence and absence of disturbance.

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INTRODUCTION

Looman (1982) and Hill (1995) recognized three zones of rough fescue in Alberta (Figure 1) each characterized by a different species (Pavlick and Looman 1984). The largest zone (I) included the Foothills and Central Parkland (Strong and Thompson 1995) of east-central Alberta and is dominated by Plains Rough fescue (*Festuca hallii*). The second zone (II) is dominated by Foothills Rough fescue (*F. campestris*) and includes the Foothills fescue, Montane and Subalpine subregions of southwestern Alberta and the Cypress Hills. The third zone (III) is dominated by Northern rough fescue (*F. altaica*) and extends north of 50° N latitude along the foothills and mountains of north-central Alberta and includes the Upper Foothills, Subalpine and Montane subregions.

Classification of the Rough fescue dominated communities have been made by Willoughby et al. (2001) for the Foothills rough fescue zone, but only a limited classification is available for the Northern rough fescue¹ zone. Particularly, it is not clear how the rough fescue grasslands are related between the Upper Foothills, Montane and Subalpine subregions.

The rough fescue grasslands of North-Central Alberta are important locally for grazing by livestock and wildlife. Morgantini and Russell (1983) found that rough fescue made up over 69% of the elk winter diet in the Ya Ha Tinda area. These grasslands are also important in maintaining the local biodiversity. Despite the importance of these grasslands there is little understanding of their ecology. Willoughby (2001) and Willoughby (1999) have identified a Rough fescue-Hairy wildrye, Rough fescue-Tufted Hairgrass and Bog birch/Rough fescue/Bearberry dominated communities in the Upper Foothills and Subalpine subregions within this zone, but no attempt has been made at examining the relationship between these community types across the various subregions. In this paper the data from the rough fescue dominated communities north of 51° N latitude located within the Upper Foothills, Subalpine and Montane subregions were combined in order to determine the similarity and successional relationships of these types.

METHODS

All of the data from the Rough fescue dominated communities identified by Willoughby (2001), Willoughby (1999) and Willoughby et al. (2001) in the Upper Foothills, Subalpine and Montane subregions of Alberta were classified using both cluster analysis (SAS) and ordination (PC-ORD). The data included plots done near the Ya Ha Tinda ranch, Harrison flats, Forty Mile Flats (Upper Clearwater Forest Land Use Zone), Ribbon Flats, Panther Corners and Wilson

¹Looman (1969) and Hill (1995) felt that the third rough fescue zone was dominated by Northern rough fescue, but there appears to be extensive overlap between this species and Foothills rough fescue, particularly in the southern part of the zone west of Rocky Mtn. House and Sundre.

Creek range allotment. These data also included rangeland reference area data from, McCue Creek, Yara Creek, Harold Creek, Upper James River, Seven mile burn, Elk Creek and Eagles Nest Cabin (Willmore Wilderness Park) (Weerstra and Willoughby 1998). The reference area data included grazed and ungrazed transects with over 30 years of data from a number of the sites. The initial classification was complicated by the fact that a number of the transects represented grazing and fire disclimax community types. In order to gain a better understanding of the ecology of these sites in the absence of disturbance only the undisturbed transects were reordinated and classified. This left 64 transects which included the inside ungrazed transects from 1981 to 2000 at the Upper James (UJR) and McCue Creek (MC) reference areas, from 1991 to 2000 at the Harold Creek (HC) reference area, from 1998 to 2000 at Eagles Nest cabin (EN) and Wilson Creek allotment (WCT01). The inside and outside transects from 1979 to 1985 at Yara Creek (YC), from 1991 to 2000 at Elk Creek (EC) and the unburned transects at Seven Mile Burn (SMB). Data from Ribbon Creek Flats (RF) prior to brush clearing (MacCallum and Yakimchuk 1992), Panther Corners (PANT)(AGRA 1998) and Forty Mile Flats (FM) were also included in the analysis.

Both the Ya Ha Tinda (YE,YW) and Harrison flats (H) areas of the province have extensive areas of rough fescue grassland that support large herds of elk. In an effort to determine how these disturbed grasslands were ecologically related to the other undisturbed rough fescue dominated community types the Ya Ha Tinda and Harrison transects were reordinated with the summarized species lists of the undisturbed Rough fescue-Hairy wildrye (HWR), Bog birch/Rough fescue/Bearberry (BEGL) and Rough fescue-Tufted hairgrass (TUFT) community types.



Figure 1. Rough fescue dominated zones in Alberta. Adapted from Looman (1982)

Ordination (DECORANA)(Gauch 1982) and cluster analysis (SAS) multivariate techniques combine the sites based on the similarity of species composition. The groupings from cluster analysis were overlaid on the site ordination. Soil moisture, nutrients, drainage, elevation and slope data were collected in the procedure outlined in the Ecological Land Survey Site Description Manual (1994). These data were correlated with the ordination axes using PC-ORD in an effort to determine which environmental variables accounted for the most variation in the species-stand table. These data were presented in a species-environment biplot.

Rangeland reference area sites were selected from within range allotments on areas that represented primary range. Originally sites thought to be in poor range condition were selected. These sites were usually represented by open grasslands on south-facing slopes, benchlands and terraces. The reference sites were not located near salt or within 100-ft. (30-m) of a fence. The preferred distance from a water source was greater than 1000-ft. (300-m) but less than 1-mi. (1.6-km). Each reference site consisted of a fenced exclosure and a 100-ft (33-m) transect inside and outside the exclosure. The outside transect was situated 25-ft (8-m) or greater from the edge of the exclosure. At 3-in. (7-cm) intervals, the basal frequency of the plant species were recorded using Parker's loop (Parker 1954). In 1981, the canopy cover of the plant species was also recorded (at 6-ft. (1.8-m) intervals) using a 20x50 cm Daubenmire frame. Presently, the transects are being recorded every three years. All the basal frequency data prior to 1981 was converted to canopy cover using regression analysis.

Transect data from non-rangeland reference area sites were collected in order to develop management plans for the various range allotments. These data were collected using the methodology outlined by Dale et al. (2001).

RESULTS

Species composition

The ordination and cluster analysis of the undisturbed rough fescue dominated communities in zone 3 is outlined in Figures 2 and 3. The first two axes in the ordination accounted for 49% and 16% of the variation in the species stand table, respectively (Figure 2). There is a distinct grouping of the transects done at Yara Creek (YC), McCue Creek (MC), Upper James River (UJR), majority of the Panther Corner transects and Forty Mile flats. These transects are dominated by rough fescue, hairy wildrye and slender wheatgrass and represent the Rough fescue-Hairy wildrye community type. The transects located at Harold Creek (HC), Eagles Nest (EN) and Wilson Creek (WCT) were all dominated by rough fescue and tufted hairgrass and they grouped together to form the the Rough fescue-Tufted hairgrass dominated community type.

The final grouping was all of the transects that were dominated by bog birch, rough fescue and bearberry. These included the Seven Mile Burn, Ribbon Flats, Elk Creek and a number of transects located within Panther Corners. Both the cluster analysis (Figure 3) and ordination (Figure 2) indicated that the Rough fescue-Tufted hairgrass and Rough fescue-Hairy wildrye dominated community types were much more similar than the transects dominated by rough fescue, bearberry and bog birch. Indeed, cluster analysis indicated that the Rough fescue-Tufted hairgrass transects grouped together within the larger Rough fescue/Hairy wildrye dominated group (Figure 3).

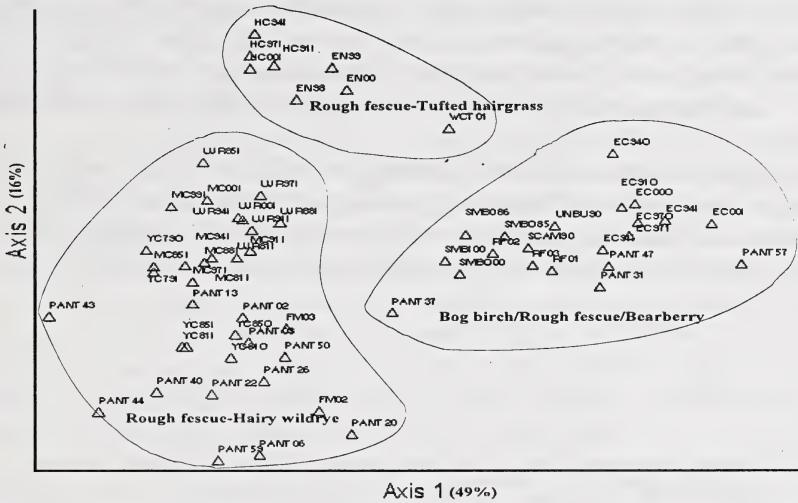


Figure 2. Ordination of undisturbed Rough fescue dominated plots in Zone III.

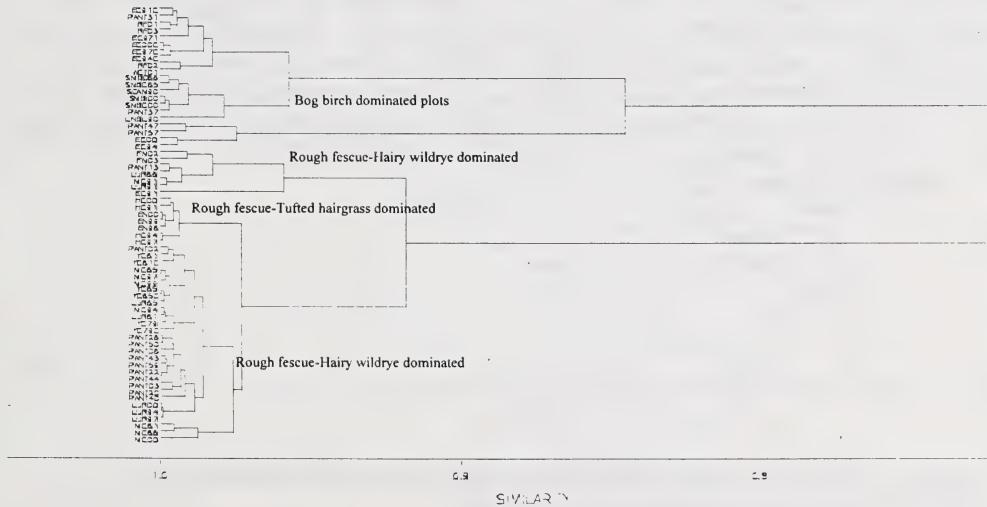


Figure 3. Cluster analysis of undisturbed Rough fescue plots in Zone III.

The species-environment biplot is outlined in Figure 4. Species characteristics of the Bog birch/Rough fescue/Bearberry community, bog birch (*betugla*), bearberry (*arctuva*), oatgrass (*dantcal*, *dantpar*), willow (*salimyr*, *salispp*, *salibeb*), scapose hawk's beard (*creprun*), blueberry (*vacccae*), alpine bistort (*polyviv*), valeriana (*valesit*), graceful sedge (*carepre*) were found on the right side of axis one and were situated around the ordinates of higher moisture and higher (poorer) drainage.

In contrast species characteristic of the Rough fescue-Hairy wildrye community, shrubby cinquefoil (*potefru*), rose (*rosaaci*), fringed and prairie sage (*artefri*, *artelud*), white scaled sedge (*carexer*), browned eyed susan (*gailari*), locoweed (*oxytmon*, *oxytser*), junegrass (*koelmac*), cut leaved anemone (*anemmum*) and bog sedge (*kobrmyo*) were found on the left side of axis 1 and

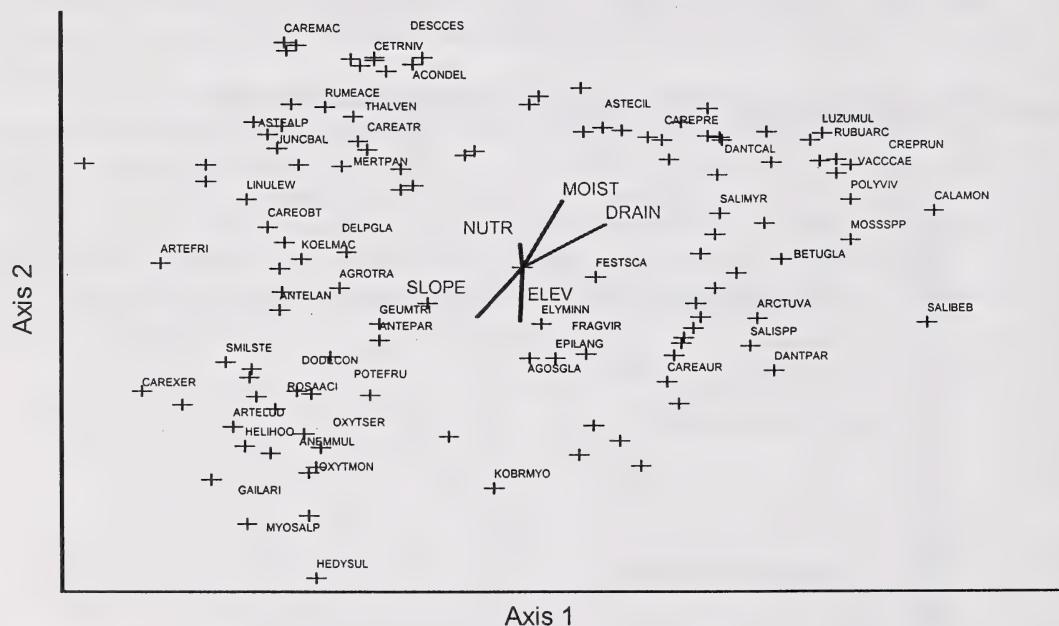


Figure 4. Biplot ordination of selected plant species and environmental variables for all undisturbed rough fescue dominated transects in zone III.

bottom of axis 2 and tended to have lower moisture, nutrients and were more rapidly drained. Many of these plots were also found at higher elevations and were located on steep south facing slopes. Species characteristic of the Rough fescue-Tufted hairgrass community, tufted hairgrass

(descces), monkshood (acondel), veiny meadow rue (thalven), thick-spiked and long-bracted sedges (caremac, careatr), tall lungwort (mertpan), dock (rumeace), arctic rush (juncbal) were found at the top of axis 2. These species were correlated with higher moisture and were found on somewhat richer sites. Species that were common to all three types tended to be found in the middle of the ordination rough fescue (festsc), hairy wildrye (elyminn), slender wheatgrass (agrotra), old man's whiskers (geumtri), strawberry (fragvir), mountain dandelion (agosgla), blunt sedge (careobt), flax (linulew), shooting star (dodecon) and fireweed (epilang).

Table 1 outlines the differences in species composition between the various community types. All three community types were dominated by rough fescue which was not significantly different between the types. The Rough fescue-Hairy wildrye community type had a significantly higher cover of shrubby cinquefoil and slender wheatgrass than the Rough fescue-Tufted hairgrass or Rough fescue/Bearberry/Bog birch community types. In contrast, the Rough fescue-Tufted hairgrass had a significantly higher cover of tufted hairgrass than the other community types and the Rough fescue/Bearberry/Bog birch community had the highest cover of bog birch, bearberry and oatgrass species (Parry and California) (Table 1).

Table 2 outlines the physical characteristics of each plant community type. The soils of each community type are very similar ranging from Orthic Eutric and Melanic Brunisols on the Rough fescue-Hairy wildrye and Bog birch/Rough fescue/Bearberry communities to Cumulic and Orthic Regosols on the Rough fescue-Tufted hairgrass community. All of the communities have fluvial and lacustrine parent materials and their textures range from loamy at the surface to Clay loams and Silty Clay Loams at depth. The pH ranges from 5-8 and the depth of the Ah horizon averages from 3-10 cm for all community types. The Rough fescue-Tufted hairgrass or Bog birch/Rough fescue/Bearberry community is slightly moister ranging from mesic to subhygric, than the Rough fescue-Hairy wildrye community type which has a submesic to mesic moisture regime. The Rough fescue-Tufted hairgrass community also has slightly poorer drainage and higher nutrients than the other community types with gleying at depth at one site.

Table 1. Canopy cover of selected species in each of the three rough fescue dominated community types in Zone III.

Species	Rough fescue- Hairy wildrye	Rough fescue- Tufted hairgrass	Rough fescue- Bearberry/ Bog birch
Shrubs			
SHRUBBY CINQUEFOIL			
(<i>Potentilla fruticosa</i>)	4a*	1b	1b
BOG BIRCH			
(<i>Betula glandulosa</i>)	0b	Tb	32a
Forbs			
OLD MAN'S WHISKERS			
(<i>Geum triflorum</i>)	9a	2c	6b
COMMON YARROW			
(<i>Achillea millefolium</i>)	3a	3a	3a
GRACEFUL CINQUEFOIL			
(<i>Potentilla gracilis</i>)	4a	2a	Ta
AMERICAN VETCH			
(<i>Vicia americana</i>)	3a	Ta	1a
MOUNTAIN DANDELION			
(<i>Agoseris glauca</i>)	1a	Ta	1a
VEINY MEADOW RUE			
(<i>Thalictrum venulosum</i>)	1b	4a	1b
TALL LARKSPUR			
(<i>Delphinium glaucum</i>)	2a	Tb	1b
BEARBERRY			
(<i>Arctostaphylos uva-ursi</i>)	1b	Tb	10a
Grasses			
NORTHERN AND FOOTHILLS ROUGH FESCUE			
(<i>Festuca altaica</i> , <i>F. campestris</i>)	21a	17a	28a
HAIRY WILDRYE			
(<i>Elymus innovatus</i>)	5a	5a	4a
SLENDER WHEATGRASS			
(<i>Agropyron trachycaulum</i>)	7a	3b	3b
SEDGE SPECIES			
(<i>Carex obtusata</i> , <i>C. siccata</i>			
<i>C.praegracilis</i> , <i>C. atrosquama</i>)	9a	9a	9a
TUFTED HAIRGRASS			
(<i>Deschampsia cespitosa</i>)	Tb	12a	Tb
JUNEGRASS			
(<i>Koeleria macrantha</i>)	1a	Tb	1b
CALIFORNIA OATGRASS			
(<i>Danthonia californica</i>)	Tb	0b	3a
PARRY OATGRASS			
(<i>Danthonia parryi</i>)	Tb	0b	2a
BOG SEDGE			
(<i>Kobresia myosuroides</i>)	1a	0a	Ta

*Means with the same letter within a row are not significantly different according to an LSMEANS test at the 0.05 level.

Table 2. Site characteristics of the three undisturbed rough fescue dominated community types in Zone III.

Site characteristics	Rough fescue -Hairy wildrye	Rough fescue -Tufted hairgrass	Rough fescue/ Bearberry/ Bog birch
Soil (subgroup)	O. Melanic Brunisol ¹ O.Eutric Brunisol ⁷ O. Humic Regosol ²	Cumulic Regosol ⁵ Orthic Regosol ⁵	O.Eutric Brunisol ¹⁰
Parent material	Fluvial, Colluvial apron, Glacial fluvial	Fluvial, Glacial Fluvial	Lacustrine, over glacial till
Surface Texture	L	L	L
Effective texture	CL, SiL, SiCL, SiC	CL, SiCL	CL, SiL, SiC
pH	5-8	5-6.5	5-8
Ah thickness (average)	2-27(10)	2-4(3)	2-5(4)
Humus form	Mor, Mull	Mor	Mull, Mor
Depth to Gleying	None	None, 60cm	None
Moisture	Submesic, Mesic	Mesic, Subhygric	Mesic, Subhygric
Nutrient	Mesotrophic, Permesotrophic	Mesotrophic, Permesotrophic	Mesotrophic
Drainage	Well	Moderately well, Well	Well
Elevation (m)	1470-2150	1370-1737	1300-1981
Aspect	Level, South	North, East, South	Level, South
Slope (%)	0-22(9)	2-3(2)	1-2(1)
Number of Soil Pits	10	2	4

1 Indicates percentage of soil pits with this soil subgroup (ie 1=10%)

Ya Ha Tinda, Harrison Flats

The ordination of the Ya Ha Tinda (YE, YW) and Harrison flats (H) transects with the summarized undisturbed rough fescue community types is outlined in Figure 5.

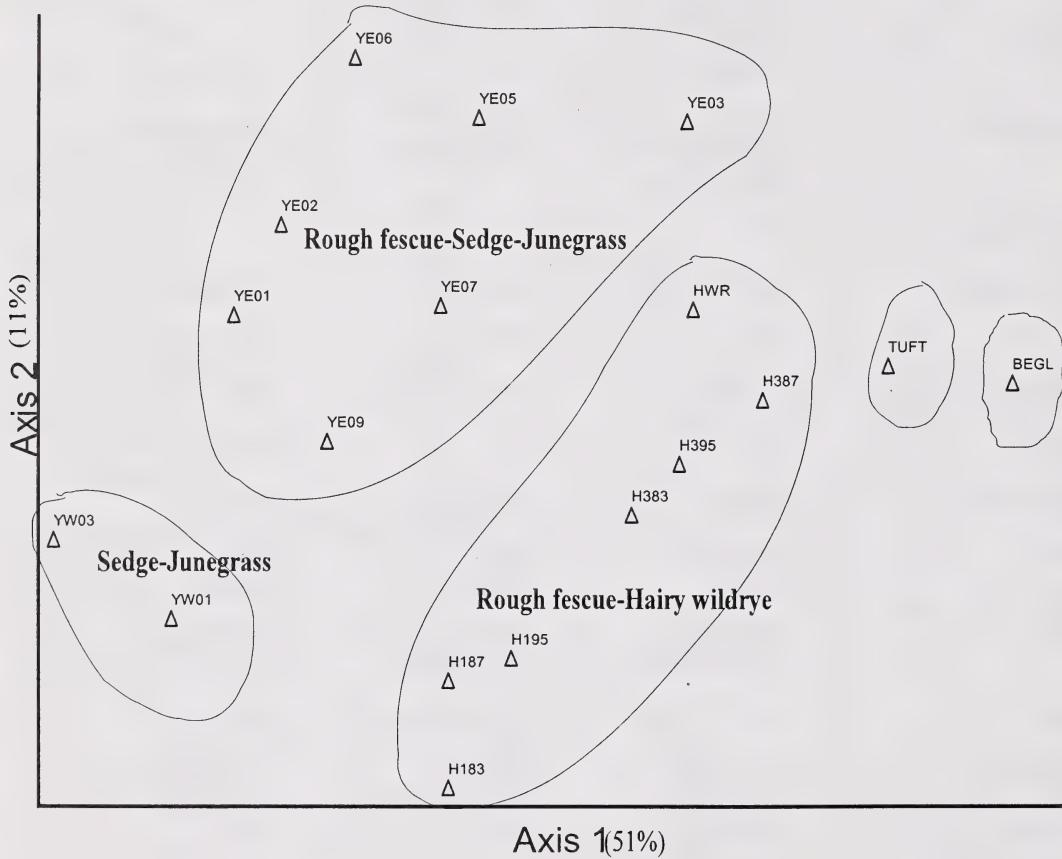


Figure 5. Ordination of Ya Ha Tinda and Harrison flats transects with the summarized undisturbed rough fescue dominated community types in Zone III

The first two axes accounted for 51% and 11% of the variation in the species-stand table respectively. The ordination indicates that the Ya Ha Tinda and Harrison flat grasslands have a closer affinity with the Rough fescue-Hairy wildrye (HWR) community than either the Rough fescue-Tufted hairgrass (TUFT) or Bog birch/Rough fescue/Bearberry (BEGL) dominated

community types.

There is a distinct grouping of the Ya Ha Tinda plots into two community types. The first type was described on grasslands east of Scalp Creek (YE). These transects were dominated by shrubby cinquefoil, rough fescue or sedge, junegrass, fringed brome, old man's whiskers and early yellow locoweed and represent the Rough fescue-Sedge-Junegrass community type (Willoughby et al. 2001). This community type was the most extensive grassland community described in the Ya Ha Tinda area. The other community type was described west of Scalp Creek near the Ya Ha Tinda ranch buildings. The transects (YW) in this community were dominated by shrubby cinquefoil, sedge, junegrass, Kentucky bluegrass, showy locoweed and cut leaved anemone. These transects represented a Sedge-Junegrass community type.

In contrast the Harrison flats transects were the most similar to the summarized Rough fescue-Hairy wildrye (HWR) community and were dominated by shrubby cinquefoil, rough fescue, sedge, junegrass, old man's whiskers and early yellow locoweed. The dominant species on the Harrison transects are very similar to the dominant species at the Ya Ha Tinda, but the cover of rough fescue averaged 35% at Harrison flats in comparison to only 10% at the Ya Ha Tinda (Appendix 1).

DISCUSSION

The rough fescue dominated grasslands follow the creeks and river valleys throughout the foothills of the Rocky Mountains north of Calgary to Willmore Wilderness park near Grande Cache. The topography of the area consists of both mountains and foothills. Closed-canopy coniferous forest dominates the area with potential climax species on modal sites being white and black spruce with lodgepole pine as an early successional species (Strong 1992). The valley bottoms have predominant willow and bog birch cover with pockets of open grassland. The south facing slopes are also covered by grassland.

The rough fescue dominated grasslands are generally found on mesic to subhygric, well drained sites within these valley bottoms and on lower slope positions of south facing slopes. On moister and richer sites tufted hairgrass and graceful sedge often replaces rough fescue as the dominate species in the community. On steep dry south facing slopes hairy wildrye, junegrass, sedge species and fringed sage tend to dominate (Willoughby 2001).

Soil moisture and nutrients appear to account for most of the variation within the ordination of the undisturbed rough fescue dominated community types. Moisture is a major limiting factor limiting the distribution of plants (Krebs 1978). In this study it appears there was a definite species response to a moisture and nutrient regime gradient. Species characteristic of moist, medium rich sites included bog birch, willow, graceful sedge, and alpine bistort. These species were indicative of the Bog birch/Rough fescue/Bearberry community type. Species characteristic of moist, rich sites included tufted hairgrass, long-bracted sedge, monkshood, tall lungwort and dock. These species were characteristic of the Rough fescue-Tufted hairgrass community type. In contrast species characteristic of dry, well drained, medium to rich sites included bog sedge, fringed sage, shrubby cinquefoil and locoweeds. These species were characteristic of the Rough fescue-Hairy wildrye community type.

Plant community ecology

Bog birch/Rough fescue/Bearberry

de Groot (1998) found that bog birch tended to prefer moist, acidic, nutrient poor organic soils which were well drained. Anderson (1975) also found that bog birch is very sensitive to extremely cold winter temperatures, but can survive temperatures to as low as -27°C if sufficient snowfall occurs. The presence of bog birch on these rough fescue dominated grasslands may indicate sites which have deeper snow accumulations, which insulate bog birch from the extreme winter conditions. The deeper snow accumulations would also increase soil moisture in the spring further favouring bog birch growth. The surface of this community is well drained and dries out quickly in the summer favouring the growth of rough fescue, junegrass, bearberry, Parry oatgrass and California oatgrass plant species.

Repeated fire (every few years) reduces bog birch canopy cover and above ground biomass, but has only a minimal effect on bog birch mortality (de Groot 1998, Bork et al. 1996). Bork et al. also found that burning bog birch three times in 9 years controlled shrub growth and increased forage production by over 40% compared to the unburned control. The increase in bog birch cover in the absence of fire is evident from the pictures taken at the Elk Creek rangeland reference area from 1968 to 2000 (Photo 1).

Rough fescue-Hairy wildrye

The Rough fescue-Hairy wildrye dominated community is found on submesic to mesic, well drained sites. This community can also be found on south facing slopes in lower slope positions where some moisture accumulates (Willoughby 2000). In the absence of grazing and fire it appears this community type will eventually succeed to conifer forest (Willoughby 2000), but the time frame for complete tree invasion appears to be greater than 60 years. Willoughby also found that increased grazing pressure by domestic livestock leads to a decline in rough fescue and other native species and allows species like Kentucky bluegrass and dandelion to dominate the site to form a Kentucky bluegrass-Sedge dominated community type.

Initial analysis of the Ya Ha Tinda ranch and Harrison flats rough fescue dominated grasslands indicated that these grasslands were very different from the other undisturbed rough fescue dominated types. Work by Looman (1969), found that these grasslands supported a large elk herd during the winter when they remained snow free. It would appear that this heavy dormant season grazing has altered the community structure so that these grasslands do not resemble the other undisturbed or grazed Rough fescue-Hairy wildrye community types. Bailey et al. (1988) found that heavy dormant season grazing lowered plains rough fescue cover and allowed species like junegrass, sedge, slender wheatgrass, fringed sage and pussytoes to increase in the Aspen parkland. They also found that forage production was significantly lower under



1968



2000

Photo 1: The lack of fire has allowed bog birch cover to increase on both the grazed and ungrazed transects at the Elk Creek rangeland reference area from 1968 to 2000.

heavy dormant season grazing compared to the ungrazed control. They concluded that heavy dormant season grazing was having the same impact on the community as a light June grazing treatment. It would appear that the heavy grazing by wildlife during the winter is having a similar affect on the majority of the Ya Ha Tinda grasslands.

The other Ya Ha Tinda grassland community type (Sedge-Junegrass) that was described by Willoughby et al. (2001) was found in an area where the Ya Ha Tinda ranch feeds hay to horses during the winter. The horses also graze this area early in the spring. This grazing pressure has allowed Kentucky bluegrass to invade onto this community type and it would appear that this community type is succeeding to a community that is similar to a number of the grazed transects of the rangeland reference areas to the east of the ranch in the Red Deer river valley (Willoughby 2000).

It would appear that the grasslands of the Ya Ha Tinda represent grazing disclimax community types. If protected from grazing these grasslands would likely succeed to a community type that is similar to the undisturbed Rough fescue-Hairy wildrye dominated type.

Rough fescue-Tufted hairgrass

The Rough fescue-Tufted hairgrass community is found on moderately well drained, subhygric, rich sites. This community type appears to represent the transition between the drier Rough fescue-Hairy wildrye community and the moister and richer Tufted hairgrass-Sedge dominated community type (Willoughby 2001). Willoughby (1998) found a 25% increase in shrub cover in only 25 years on the Tufted hairgrass-Sedge community type, but this community type is rarely shrub covered. Photos taken at the Harold Creek rangeland reference area in 1963 and again in 2000 show little shrub expansion in over 30 years of no disturbance (Photo 2). Lane et al. (2001), have found that there has only been an 18% increase in shrub cover on this community type in Willmore Wilderness Park in over 40 years. Presently it is not clear why shrub expansion is slower in this community type.

Continued grazing pressure causes rough fescue to decline and initially tufted hairgrass and sedge increase in cover. However, continued grazing pressure causes a further decline in all native species and the site will become dominated by Kentucky bluegrass, dandelion and clover species (Willoughby 2001). In Willmore where there is little seed source for Kentucky bluegrass and these heavily grazed Rough fescue-Tufted hairgrass types are often dominated by alpine timothy, slender wheatgrass, sedge and tufted hairgrass. Many of the sites have also been invaded by tall buttercup.

SUMMARY

The fescue grasslands of Alberta represent some of the most ecologically diverse areas of the province. Historically, the desired plant community of these grasslands was one that maximized beef production, which has led to a decline in condition of many of these grassland communities. In recent years there has been a movement towards more sustainable use of our natural resources. The scope of sustainability has shifted from being defined by economic assessment to include broader sustainability of ecological functions and patterns (Lee and



1963



1994

Photo 2: In over 30 years of protection from grazing and fire there has been little shrub expansion at the Harold Creek rangeland reference area. However, shrub expansion has continued on the moister sites in the background

Hanus 1998). Today society desires the conservation of native plant communities. In North-central Alberta these rough fescue dominated grasslands are important locally for both wildlife and domestic livestock. They also contribute to the local biodiversity of the area. Despite their importance there is only limited understanding of their ecology. This paper describes and presents a classification of the rough fescue dominated community types of the foothills of North-central Alberta. This classification recognizes three rough fescue dominated community types and outlines the successional relationships of each type. Hopefully, this classification can be used to ensure the conservation of these native grasslands.

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APPENDIX ONE:

**VEGETATION SPECIES LISTS FOR THE VARIOUS PLANT COMMUNITY TYPES:
INCLUDES YA HA TINDA AND HARRISON FLATS**

Group name: Rough fescue-Hairy wildrye

(continued)

Group name: Rough fescue-Hairy wildrye

		Plots													
		Avg	Avg	MC81I	MC85I	MC88I	MC91I	MC94I	MC97I	MC99I	MC00I	YC79I	YC790	YC81I	YC810
% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
6	41	SPECIES	11.4	00.1											
	42	ERGSPP	11.4	00.1											
	43	RUMEOCC	11.4	00.1											
	44	SOLIMUL	11.4	00.1											
	45	HEUCRIC	11.4	00.1											
	46	GALTARI	11.4	00.0											
	47	ARTELUD	08.6	00.3											
	48	ASTEALP	08.6	00.1											
	49	PENSPRO	08.6	00.0	00										
	50	TRIFREP	08.6	00.0											
	51	BOTRLUN	08.6	00.0											
	52	BEDYALP	05.7	00.2											
	53	GEARIC	05.7	00.1											
	54	ANDRSEP	05.7	00.0											
	55	SENEPAU	05.7	00.0											
	56	ARABHTR	05.7	00.0											
	57	ASTECON	05.7	00.0	00										
	58	GEMMALE	05.7	00.0											
	59	POTENS	02.9	00.1											
	60	HEDSUL	02.9	00.1											
	61	ANDRCHA	02.9	00.1											
	62	PLANMAJ	02.9	00.1											
	63	CASTFLA	02.9	00.1											
	64	POTEDIV	02.9	00.0											
	65	HETEVIL	02.9	00.0											
	66	POTEPEN	02.9	00.0											
	67	MIMUGUT	02.9	00.0											
	68	HIERCYN	02.9	00.0											
	69	ANTELAN	02.9	00.0											
	70	HIERUMB	02.9	00.0											
	71	VALEDIO	02.9	00.0											
	72	POLEPUL	02.9	00.0											
	73	GENITGLA	02.9	00.0											
	74	POTEFRU	02.9	00.0											
	75	RAUCAR	02.9	00.0											
	76	SISYMON	02.9	00.0											
	77	ANAPMAR	02.9	00.0											
	78	OXYTSPL	02.9	00.0											
	79	GENTCAL	02.9	00.0											
	80	PENSON	02.9	00.0											

(Continued)

roup name: Rough fescue-Hairy wildrye

(Continued)

Group name: Rough fescue-Hairy wildrye

		Plots														
		Avg	Avg	MC81I	MC85I	MC88I	MC91I	MC94I	MC97I	MC99I	MC00I	YC79I	YC790	YC81I	YC810	YC85I
LAYER	n	% P	MC	Cv	Vg	Cv										
8	121	OXYTSER	02.9	00.0												
	122	MOSSSPP	02.9	00.0												
	123	ANEMMUL	02.9	00.0												
	124	AGOSGLA	02.9	00.0												
	125	DODECON	02.9	00.0												

(continued)

Group name: Rough fescue-Hairy wildrye

		Plots																				
		YCB50			UJR81I			UJR85I			UJR88I			UJR91I			UJR94I			UJR97I		
		Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	
LAYER	N	SPECIES																				
5	1	POTEFRU	0.1																			
	2	ARCTUVA																				
	3	ROSACI																				
	4	POPUTRE																				
	5	POTEGRA	0.0																			
	6	POTEGRA	0.1	0.7	0.3	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
		ACHMIL	0.1	0.2	0.5	0.3	0.2	0.6	0.2	0.4	0.5	0.3	0.3	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0.0	
	7	GALIBOR	0.1	0.6	0.8	0.5	0.5	0.5	0.5	0.3	0.3	0.1	0.3	0.1	0.8	0.2	0.2	0.1	0.0	0.1	0.1	
	8	GEMUNTRI	0.6	0.2	0.2	0.7	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
	9	VICTNAME	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	10	AGOSGLA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	11	CERAARY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	12	CAMPROT	0.0																			
	13	DELPGLA	0.1	0.1	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.5	0.1	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.1	
	14	TAROFF	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	15	THALVEN	0.0	0.1	0.6	0.7	0.2	0.3	0.1	0.1	0.1	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	16	FRASVIR	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	17	DODECON	0.0																			
	18	ASTELAE	0.1																			
	19	EPILANG	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	20	ANEMMUL	0.0																			
	21	ASTRALP	0.0																			
	22	LINULEW	0.0																			
	23	ALLICER	0.0																			
	24	ZIZIAPT	0.0																			
	25	SMILSTE	0.0																			
	26	OXYTSER	0.0																			
	27	HEVDBOR																				
	28	MERTPAN	0.0																			
	29	ANTEPAR	0.0																			
	30	STELLON	0.0																			
	31	RUMFACE																				
	32	VIOLADU																				
	33	SOLIMIS	0.0																			
	34	LATHOCH	0.0																			
	35	OXYTMON	0.1																			
	36	ARTEFRI																				
	37	MYOSALP																				
	38	GENTAMA																				
	39	ASTECIL	0.0																			
	40																					

(Continued)

Group name: Rough fescue-Hairy wildrye

LAYER	n	SPECIES	Plots												PANT26	
			YCB50	UJR81I	UJR85I	UJR88I	UJR91I	UJR94I	UJR97I	UJR001	PANT02	PANT13	PANT03	PANT43	PANT50	
Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	PANT26
6	41	ERISPP														
	42	RUMECC	00	00	00	00										
	43	SOLIMUL	00													
	44	HEUCRIC														
	45	GAILARI														
	46	ARTELUD														
	47	ASTEALP	00	00	01											
	48	PENSPRO														
	49	TRITREP	00	00	00											
	50	BOTRLUN														
	51	HEDALP														
	52	GERATIC														
	53	ANDRSEP														
	54	SENEPAU														
	55	ARABHIR														
	56	ASTECON	00	00	00											
	57	GEJUALE														
	58	POTEANS														
	59	HEDYSUL														
	60	ANDRCHA														
	61	PLAMMAM														
	62	CASTFLA	00	00	00											
	63	POTEDIV														
	64	HETEVIL														
	65	POTEPEN														
	66	SONCARV														
	67	HIERCYN														
	68	ANTELAN														
	69	HIERUMB														
	70	VALEDIO														
	71	MIMUGUT														
	72	POLFUL														
	73	GENTGLA														
	74	POTEFRU														
	75	RAUCAR														
	76	SISYMON														
	77	ANAPMAR														
	78	OXYTSPL														
	79	GENITAL														
	80	PENSON														

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Group name: Rough fescue-Hairy wildrye

LAYER	SPECIES	Plots																				
		YCB50			UJR81I			UJR85I			UJR88I			UJR91I			UJR94I			UJR97I		
		Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	
6	POTEARGL																					
	ZIGAEL	82																				
	ARNICHA	83																				
	GEUMMAC	84																				
	POLEACU	85																				
	RHINMIN	86																				
	FESTSCA	87																				
	AGROTHA	88																				
	ELYMINTN	89																				
	KOELMAC	90																				
	BROMCIL	91																				
	JUNCBAL	92																				
	POA PRA	93																				
	CAREOBT	94																				
	BROMINE	95																				
	HELIHOO	96																				
	CAREPRE	97																				
	POA SPP	98																				
	CARESPP	99																				
	CAREXER	100																				
	FESTSAX	101																				
	PHLEPRA	102																				
	FESTIDA	103																				
	CAREATR	104																				
	BROMPUM	105																				
	KOBMYO	106																				
	CARESP2	107																				
	DANTPAR	108																				
	AGROSMI	109																				
	HIERODO	110																				
	DANTCAL	111																				
	FESTOVI	112																				
	DESCCES	113																				
	CARESP1	114																				
	CARESIC	115																				
	STIPVIR	116																				
	CAREFIL	117																				
	AGROELY	118																				
	POA ALP	119																				
	AGROSTO	120																				

Group name: Rough fescue-Hairy wildrye

		Plots													
		YCR50	UJR81I	UJR85I	UJR88I	UJR91I	UJR94I	UJR97I	UJR00I	PANT02	PANT13	PANT03	PANT43	PANT50	PANT26
		Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER		SPECIES	OXYTER	MOSSPP	ANEMMUL	AGOSGLA	DODECON								
8		121													
		122													
		123													
		124													
		125													

(Continued)

Group name: Rough fescue-Hairy wildrye

LAYER	N	SPECIES	Plots																						
			PANT22			PANT40			PANT44			PANT59			PANT06			PANT20			FM03				
			Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv		
5	1	POTEFRU	03	31	04	08			10		02		04		01		00		11						
	2	ARCTUVA	03																						
	3	ROSAICI	00																						
	4	POPOTRE																							
	5	POTEGRA	01	04		00	03		00		01		01		06										
	6	ACHIMIL	00	03	00	00	00		00		00		00		01		00								
6	7	GALIBOR	00	00	00	00																			
	8	GEUMTRI	03	03	01	01	08		04		00		01		21		15								
	9	VICIANE	03	04	01	00	01		01		00		01		06		02								
	10	AGROGLA	01																						
	11	CERAARV	02	00	01	00	00		00		00		00		00		00								
	12	CAMPROT	03	02	01	00	00		00		01		00		00		00								
13	13	DELPGLA																							
	14	TARAOFF	00																						
	15	THALVEN																							
	16	FRAGVTR	00	03		03			00		07		00												
	17	DODECON	00	00		00			01		00		01		02		00								
	18	ASTELAE	00	00		00			00		00		01		02		02								
19	19	ASTELANG	00	01	00	00			00		00		02		00		01								
	20	ANEMMUL	02	00	01	00			00		00		01		01		02								
	21	ASTRALP																							
	22	LINULEW																							
	23	ALLICER																							
	24	ZIZIAPT																							
25	25	SMILSTE	00			00			00		05		01		00		11								
	26	OXYTSER	03	01	07				07		05		06		11										
	27	VIOLADU	02	00	00				00		06		00		05										
	28	MERTPAN																							
	29	ANTEPAR	02	00	00	00			00		00		01		03		07								
	30	STELLON	00																						
31	31	RUNEACE																							
	32	SOLIMIS	00																						
	33	LATHOCH	00																						
	34	OXYTMON																							
	35	ARTEFII	00																						
	36	MYOSALP	00																						
37	37	GENTANA																							
	38	ASTECIL																							
39	39																								
	40																								

Group name: Rough fescue-Hairy wildrye

LAYER	SPECIES	Plots											
		PANT22	PANT40	PANT44	PANT59	PANT6	PANT20						
Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
6	ERIGSP												
41													
42	RUMEOCC	00		01		01							00
43	SOLINUL												01
44	HEURIC												
45	GAILARI	00				01							
46	ARTELUD												
47	ASTEALP												
48	PENSRO												
49	TRIFREP												
50	BOTRLUN												
51	HEDYALP												00
52	GERARIC												
53	ANDREP	00		00									
54	SENEFAU												
55	ARABIR												
56	ASTECON												
57	GEUMALE												
58	POTTEANS												
59	HEDYSUL												
60	ANDROCHA												
61	PLANIAJ												
62	CASTELA												
63	POTEDIV												
64	HETEVYL												
65	POTEPEN												
66	SONCARV												
67	HIERCYN												
68	ANTELAN												
69	HIERUMB												
70	VALIEDTO												
71	MIMUGUT												
72	POLEPUL												
73	GENTGLA												
74	POTEFRU												
75	RANUGAR												
76	SISYMON												
77	ANAPHAR												
78	OXYTSPL												
79	GENTCAL												
80	PENSON												

(Continued)

Group name: Rough fescue-Hairy wildrye

LAYER	SPECIES	Plots																								
		PANT22			PANT40			PANT44			PANT59			PANT06			PANT20			FM03			FM02			
		Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	
6	POTEAU																									
	ZIGAELLE																									
	ARNICHA																									
	GELINNAC																									
	POLEACU																									
	RHINNIN																									
7	FESTSCA	14		21		10		15		28		15		32		43										
	AGROTRIA	00		03		01		05		02		03		22		12										
	ELYMENN	02		01		01		08		03		18		17		02										
	KOELMAC	04		00		01		00		00		00		01		02										
	BROMCTL																									
	JUNCBAL																									
	POA PRA																									
	CAEGBT																									
	BROMINE	02		00		04		04		07																
	HELIHO	01		00		01		00		00																
	CAEPRE																									
	POA SPP																									
	CAESPP	99																								
	CAEEXER	05		11		08		03		02		02		00		00										
	FESTSAX	02																								
	PHLEPRA																									
	FESTIDA	103																								
	CAREATR																									
	BROMPUM	105																								
	KOERNMYO	106																								
	CARESP2	107																								
	DANTPAR	108																								
	AGROSMI	109																								
	HIERODO	110																								
	DANTCAL	111																								
	FESTOVI	112																								
	DESCCES	113																								
	CARESP1	114																								
	CARESIC	115																								
	STIPVIR	116																								
	CAREFIL	117																								
	AGROLY	118																								
	POA ALP	119																								
	AGROSTO	120																								

Group name: Rough fescue-Hairy wildrye

Group name: Bog birch/R.fescue/Bearberry

		Plots																														
		Avg		EC910		EC911		EC940		EC941		EC971		EC970		EC001		EC000		SMB085		SMB086		SMB100		SMB000		SCAM90				
% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg					
5	SPECIES	0100	32.2	41	14	23	15	12	32	20	32	20	35	30	30	26	42	01	01	04	01	01	00	00	00	00	03					
	BETUGLA	66.7	01.4																													
	POTEFERU	38.1	00.5																													
	SALIMYR	14.3	00.7																													
	SALISPP	09.5	02.0																													
6	ARCTUBA	04.8	00.5																													
	SALIATH	04.8	00.0																													
	FRAGVIR	0100	02.6	00	00	02	00	05	01	01	03	02	04	02	01	00	00	01	03	04	02	02	02	02	02	02	02					
	ACHIMIL	0100	02.6	02	00	00	00	05	01	01	03	02	04	02	01	00	00	01	03	02	01	00	00	00	00	00	00					
	GEUMTRI	90.5	05.5	01	03	01	03	01	03	01	03	02	04	02	01	00	00	01	03	02	01	00	00	00	00	00	00					
10	GALIBOR	81.0	01.1	00	00	01	01	01	01	01	01	01	00	01	00	00	00	00	00	00	00	00	00	00	00	00	00	00				
	AGLOSSA	76.2	00.7	02	01	02	00	02	00	00	01	01	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00				
	ARCTUVA	71.4	09.1	07	24	06	20	12	05	14	06	13	06	15	08	06	06	13	15	08	02	02	02	02	02	02	02	02				
	ASTRALP	71.4	01.6	01	01	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00				
	PENSPRO	66.7	01.3	03	00	02	01	00	02	01	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00				
15	ZIZZIAPT	66.7	00.5	00	00	00	00	00	00	00	01	01	00	01	00	00	00	00	00	00	00	00	00	00	00	00	00	00				
	VICTIALE	61.9	01.3																													
	EPILANG	57.1	01.7																													
	ASTELAE	57.1	01.5																													
	TRABOFF	57.1	00.4	02	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00				
21	CERAARV	52.4	00.3	00	00	00	00	00	00	00	01	01	02	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00				
	SOLIMUL	42.9	01.0																													
	THALVEN	42.9	00.7																													
	DELPGLA	42.9	00.7																													
	LATHOCH	42.9	00.6																													
26	POTEHIP	38.1	01.0	02	02	04	01	01	01	01	01	01	02	03	02	02	02	02	02	02	02	02	02	02	02	02	02	02	02			
	VIOLADU	38.1	00.5	02	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00			
	POTEGRA	38.1	00.4																													
	POLVVIV	38.1	00.3	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00			
	VACCIAE	33.3	01.8	08	02	07	05	03	05	03	05	03	05	03	05	03	05	03	05	03	05	03	05	03	05	03	05	03	05			
31	CREPRUN	33.3	01.1																													
	ANTEPAR	33.3	00.2	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00			
	CAMPROT	33.3	00.1																													
	HEDTALP	28.6	01.0																													
	SOLIMTS	28.6	00.5	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00			
36	RUBJARC	28.6	00.4	01	01	06	01	01	01	01	01	01	07	01	01	07	01	01	01	01	01	01	01	01	01	01	01	01	01	01		
	OXYTSER	28.6	00.3																													
	GENTAMA	28.6	00.1	00	01	01	01	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00		
	HEDYBOR	19.0	00.4																													
	STELLON	19.0	00.3																													

(Continued)

		Plots																																									
		Avg			EC910			EC911			EC940			EC941			EC971			EC970			EC001			EC000			SMB035			SMB086			SMB000			SMB100			SMB000		
		% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg								
6	41	SPECIES	14.3	00.3																																							
6	42	OXYTSPL	14.3	00.1																																							
6	43	POTEDIV	09.5	00.4																																							
6	44	ASTECIL	09.5	00.1																																							
6	45	SENECAN	09.5	00.1	02	00																																					
6	46	VALESIT	09.5	00.1																																							
6	46	SENEPAU	09.5	00.1																																							
6	47	NOEFLAT	09.5	00.0																																							
6	48	ANDRCHA	09.5	00.0																																							
6	49	CIRSUND	09.5	00.0																																							
6	50	RUMFOCC	09.5	00.0																																							
6	51	SMILSTE	09.5	00.0																																							
6	52	ANENLIT	09.5	00.0																																							
6	53	MERTPAN	04.8	00.3																																							
6	54	SAXITRI	04.8	00.2																																							
6	55	PENSCON	04.8	00.2																																							
6	56	VALEDIO	04.8	00.0																																							
6	57	ANTEANA	04.8	00.0																																							
6	58	DODECON	04.8	00.0																																							
6	59	GENITAL	04.8	00.0																																							
6	60	HEURIC	04.8	00.0																																							
6	61	SENEINT	04.8	00.0																																							
6	62	ANTELAN	04.8	00.0																																							
6	63	CIRSVUL	04.8	00.0																																							
6	64	RAUNURHO	04.8	00.0																																							
6	65	VOLCAN	04.8	00.0																																							
6	66	FESTSCA	01.00	27.8	29																																						
6	67	CAREPRE	66.7	06.7	16	02	08	04																																			
6	68	ELMINN	66.7	04.1	00																																						
6	69	DANICAL	66.7	02.7	05	07	11	06																																			
6	70	AGROTRA	61.9	02.6																																							
6	71	DANTPAR	38.1	01.8																																							
6	72	FESTSAX	33.3	01.0																																							
6	73	AGROEL	23.8	03.1																																							
6	74	BROMCIL	23.8	01.3																																							
6	75	CARESIC	23.8	00.5																																							
6	76	CARESPP	19.0	01.1																																							
6	77	POA PRA	19.0	00.3																																							
6	78	SCHIPUR	14.3	00.7																																							
6	79	KOBMYO	14.3	00.4																																							
6	80	BROMINE	14.3	00.4																																							
7																																											

Group name: Bog birch/R. fescue/Bearberry

		Plots																																									
		Avg			EC910			EC911			EC940			EC941			EC970			EC971			EC001			EC000			SMB085			SMB086			SMB100			SMB000			SCAM90		
		% P	MC	Cv	Vg	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg									
LAYER	n	SPECIES																																									
7	81	DESCES	14.3	00.2	02																																						
	82	FESTIDA	09.5	00.5	08																																						
	83	LUZIMUL	09.5	00.1																																							
	84	POA INT	09.5	00.1																																							
	85	JUNCBAL	09.5	00.0																																							
	86	PHLECOM	09.5	00.0																																							
	87	BROMPUM	09.5	00.0																																							
	88	MUHLCUS	09.5	00.0																																							
	89	KOELMAC	04.8	00.4																																							
	90	CAREOBT	04.8	00.3																																							
	91	CAREATR	04.8	00.1																																							
	92	CAREAUR	04.8	00.0																																							
	93	POA COM	04.8	00.0	00																																						
	94	FESTRUB	04.8	00.0																																							
	95	CALAMON	04.8	00.0																																							
	96	AGROMER	04.8	00.0																																							
	97	AGROSCHA	04.8	00.0																																							
	98	POA ALP	04.8	00.0																																							
	99	CALACAN	04.8	00.0																																							
8	100	MOSSSPP	66.7	27.2	30																																						
9	101	PELTCAN	19.0	00.3																																							
	102	CLADSPP	09.5	00.0																																							

(Continued)

Group name: Bog birch/R. fescue/Bearberry

LAYER	SPECIES	Plots														
		UNBU90	PANT31	PANT37	PANT57	PANT47	RF01	RF02	RF03	Cv	Vg	Cv	Vg	Cv	Vg	Cv
5	BETUGLA	70	39	24	62	30	33	20	40	03	06	04	01	01	00	
	POTEFRU	03	02	06												
2	SALIMYR	02														
3	SALISPP	07														
4	SALIBEB															
5	ARCTUVA	10														
6	SALIATH															
7	FRAGVIR	04	01	02	00	04	05	09	08							
8	ACHIML	03	01	03	00	02	05	02	01							
9	GEUMTRI	05	06	07	01			05	07							
10	GALIBOR	02	00	00	00											
11	AGGSGLA	00														
12	ARCTUVA															
13	ASTRALP															
14	PENSPRO															
15	ZIZIAPT	02	02	08	01	02	01	01	01							
16	VIGIANE	02	02	02	02	06	02	02	08							
17	EPTLANG	04														
18	ASTELAE	03	00	00	00	05		03	03							
19	TAHOFF															
20	CERBARV	00														
21	SOLIMUL															
22	THALVEN	02														
23	DELPGLA															
24	LATHOCH															
25	POTEHIP															
26	VIOLADU															
27	POTEGRA															
28	POLYVV															
29	VACCAE															
30	CREPRUN															
31	ANTEPAR	00														
32	CAMPROT															
33	HEDYALP															
34	SOLIMIS															
35	RUBARC															
36	OXYSER	00	00	00	00	00	00	00	00							
37	GENTAMA	00	02	02	05	05	05	05	01							
38	HEDYBOR	01														
39	STELLON															
40																

(Continued)

group name: Bog birch/R. fescue/Bearberry

(Continued)

Group name: Bog birch/R. fescue/Bearberry

Group name: Rough fescue-Tufted hairgrass

SPECIES	LAYER	n	Avg	Avg	% P	MC	Plots																							
							HCG1			HCG4I			HC97I			HC00I			EN98			EN99			EN00			WCT01		
							Vg	Cv	Vg	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg				
POTEFRU	5	1	37.5	0.0	0.8							01	01													03	03	03		
BETUGLA	5	2	12.5	0.0	0.4							08	05													01	01	00		
ACHIMIL	6	3	0100	0.0	0.1	02						02	01													01	01	00		
GALIBOR	6	4	0100	0.0	0.6	01						00	00													00	00	00		
RUMACE	5	5	0100	0.0	0.7	01						07	06													01	01	00		
THALVEN	6	6	87.5	0.4	0.3	05						02	04													04	04	02		
POTEGRA	7	7	87.5	0.2	0.1							02	04													00	00	03		
CERAARV	8	8	87.5	0.0	0.7	01						02	00													00	00	00		
FRAGVIR	9	9	87.5	0.0	0.7	00						00	01													00	00	00		
PENSPRO	10	10	75.0	0.6	0.6	06						11	18													09	05	01		
MERTPAN	11	11	62.5	0.1	0.3							00	00													03	02	02		
CAMPROT	12	12	62.5	0.0	0.2							00	00													00	00	00		
GEUMTRI	13	13	50.0	0.1	0.5	01						03	05													02	00	00		
DELPLGA	14	14	50.0	0.0	0.3							00	00													00	00	00		
ARNICHA	15	15	50.0	0.0	0.2	00						00	00													00	00	00		
VICIANME	16	16	50.0	0.0	0.1	00						00	00													00	00	00		
AGOSGLA	17	17	50.0	0.0	0.1	00						00	00													00	00	00		
ASTELAE	18	18	37.5	0.2	0.2	04						09	02													00	00	00		
ACONDEL	19	19	37.5	0.1	0.1							00	00													02	02	04		
EPI1LANG	20	20	37.5	0.0	0.2							01	01													00	00	00		
ZIZIAPT	21	21	37.5	0.0	0.2							00	00													00	00	00		
SOLINUL	22	22	37.5	0.0	0.2							00	00													00	00	00		
ASTRALP	23	23	37.5	0.0	0.1							00	00													00	00	00		
TARAOFF	24	24	37.5	0.0	0.1							00	00													00	00	00		
RUBUARC	25	25	37.5	0.0	0.1							00	00													00	00	00		
PENSON	26	26	25.0	0.0	0.8							04	02													20	10	03		
POTEARG	27	27	25.0	0.0	0.9							00	00													02	01	01		
POTEDIV	28	28	25.0	0.0	0.5							00	00													00	00	00		
POTEHIP	29	29	25.0	0.0	0.4							00	00													00	00	00		
DRABSPP	30	30	25.0	0.0	0.2							00	00													00	00	00		
VIOLADU	31	31	25.0	0.0	0.0							00	00													00	00	00		
ASTECIL	32	32	12.5	0.0	0.3							00	00													00	00	00		
CIRSUMD	33	33	12.5	0.0	0.1							01	01													00	00	00		
STELLON	34	34	12.5	0.0	0.1							01	01													00	00	00		
SENEPAU	35	35	12.5	0.0	0.1							00	00													00	00	00		
VALESIT	36	36	12.5	0.0	0.1							00	00													00	00	00		
GEUMALE	37	37	12.5	0.0	0.1							00	00													00	00	00		
ARCTUVA	38	38	12.5	0.0	0.1							00	00													00	00	00		
ANTELAN	39	39	12.5	0.0	0.0							00	00													00	00	00		
PEDIGRO	40	40	12.5	0.0	0.0							00	00													00	00	00		

Group name: Rough fescue-Tufted hairgrass

Plots

Group name: Harrison flats

LAYER	SPECIES	n	Avg	Avg	Plots							
					% P	MC	Cv	Vg	Cv	Vg	Cv	Vg
5	POTEFRU	1	0.100	09.9	10			05	02		15	13
	JUNJHOR	2	16.7	00.8	05					00		
	SALISPP	3	16.7	00.0					01	04	05	01
6	THALVEN	4	0.100	02.9	00			05	01	00		
	GALIBOR	5	0.100	01.2	01			01	00	01	02	00
	OXYTMON	6	83.3	08.7	10			26	06	07		01
	ACHIMIL	7	83.3	03.9	00			10		01	07	03
	HEDYALP	8	83.3	02.6	00			00	00	00	13	00
	ERICGAE	9	83.3	01.4	00			05	02	00	00	
	AGOGGLA	10	83.3	01.3	00			00	00	01	01	04
	CERARAV	11	83.3	01.0	00			01		01	01	
	GEUNTRI	12	66.7	07.3	00					01	20	17
	DELGLA	13	66.7	02.2				00	00	00	07	05
	CAMPROT	14	66.7	01.5	00			05	02	00	00	04
	STELLION	15	66.7	00.6	01				01	00	00	
	ANTEPAR	16	50.0	03.2	06			12				
	TARAOFF	17	50.0	00.6				00		00	02	
	CREPRUN	18	50.0	00.5				00		00	00	02
	ANEMMUL	19	50.0	00.5	00				02	00		
	POTEDIV	20	50.0	00.2					00	00	00	00
	SISYMON	21	50.0	00.2				00		00	00	
	POTEGRA	22	50.0	00.1				00		00	00	
	ANDRCHA	23	33.3	02.1				10	02			
	SELADEN	24	33.3	01.7	05							
	ARTEFRI	25	33.3	01.0	05			01				
	RUMFACE	26	33.3	00.5						00	02	
	LINULEW	27	33.3	00.4						00	00	02
	ZIZAAPT	28	33.3	00.2						00	00	
	GENTAMA	29	33.3	00.1	00					00	00	
	ASTRALP	30	33.3	00.1							00	
	ARNIFUL	31	16.7	01.1							06	
	ARCTUVA	32	16.7	00.8	05							
	POTEPEN	33	16.7	00.8				05				
	ASTECIL	34	16.7	00.5							03	
	ASTRBOU	35	16.7	00.2							01	
	SOLIMUL	36	16.7	00.2								
	RANUCYM	37	16.7	00.1								
	DODEPUL	38	16.7	00.1								
	OXYTOEF	39	16.7	00.0							00	
	VIOADU	40	16.7	00.0								

(Continued)

Group name: Harrison flats

Group name: Ya Ha Tinda (R.fescue-H.wildrye

LAYER	n	SPECIES	Avg	Avg	Plots									
					% P	MC	Cv	Yg	Cv	Vg	Cv	Vg	Cv	Vg
5	1	POTERFRU	85.7	02.0	00	02	00	01	02	01	00	02	00	04
	2	POPUTRE	28.6	00.2	00	00	00	00	00	00	00	00	00	00
	3	BETUGLA	14.3	00.6	04	00	00	00	00	00	00	00	00	00
	4	SALIGLA	14.3	00.2	01	00	00	00	00	00	00	00	00	00
	5	ROSAACI	14.3	00.1	00	00	00	00	00	00	00	00	00	00
6	6	CAMPPIOT	0100	01.1	00	03	00	00	00	00	00	00	00	01
	7	OXYTMON	85.7	07.8	01	03	00	01	01	01	01	12	27	07
	8	HEDYALP	85.7	02.8	00	05	00	09	00	00	03	00	00	00
	9	AGOSGLA	85.7	01.7	01	01	00	01	01	01	02	04	00	00
	10	GALIBOR	85.7	01.3	00	03	00	00	00	00	02	01	01	00
	11	ANTIFAR	85.7	01.0	00	00	00	00	00	00	01	03	00	00
	12	ASTELAE	85.7	00.7	00	01	01	01	00	00	00	00	00	00
	13	GEUMTRI	71.4	09.0	03	14	20	12	12	12	12	12	12	12
	14	ANEMMUL	71.4	01.5	00	01	01	01	01	01	02	01	03	01
	15	ANDRCHA	71.4	00.8	00	00	00	00	00	00	02	02	00	00
	16	POTEGRA	71.4	00.5	01	00	00	00	00	00	01	00	00	00
	17	ACHIMIL	57.1	02.4	00	08	04	04	04	04	02	02	02	02
	18	THALOCC	57.1	00.9	00	02	02	02	00	00	01	02	02	02
	19	ARTEFRI	57.1	00.4	00	00	00	00	00	00	01	00	00	00
	20	CERARV	57.1	00.2	00	00	00	00	00	00	00	00	00	00
21		ANTELAN	42.9	02.2	00	09	00	00	00	00	03	03	02	02
	22	VICIANE	42.9	01.5	05	04	00	00	00	00	00	00	00	00
	23	OXYTSPL	42.9	01.1	00	00	00	00	00	00	06	06	00	00
	24	ASTECL	42.9	00.5	00	00	00	00	00	00	01	00	00	00
	25	VIOLADU	42.9	00.1	00	00	00	00	00	00	00	00	00	01
	26	COMAUMB	28.6	00.7	03	03	00	00	00	00	00	00	00	00
	27	LINULEW	28.6	00.4	00	00	00	00	00	00	02	02	02	02
	28	SOLINUL	28.6	00.4	00	00	00	00	00	00	00	00	00	00
	29	THALVEN	28.6	00.4	01	01	01	01	01	01	00	00	00	00
	30	FRAGVIR	28.6	00.4	01	01	01	01	01	01	00	00	00	00
	31	DELPGLA	28.6	00.3	01	01	01	01	01	01	00	00	00	00
	32	ZIZIAPT	28.6	00.1	00	00	00	00	00	00	00	00	00	00
	33	EPI LANG	28.6	00.1	00	00	00	00	00	00	00	00	00	00
	34	SMILSTE	14.3	00.4	00	00	00	00	00	00	02	02	02	02
	35	ANTEROS	14.3	00.3	02	02	02	02	02	02	00	00	00	00
	36	OXYTSET	14.3	00.3	00	00	00	00	00	00	02	02	02	02
	37	LATHOCH	14.3	00.1	00	00	00	00	00	00	00	00	00	00
	38	HIERUMB	14.3	00.0	00	00	00	00	00	00	00	00	00	00
	39	PENSPRO	14.3	00.0	00	00	00	00	00	00	00	00	00	00
	40	POTEDLY	14.3	00.0	00	00	00	00	00	00	00	00	00	00

(Continued)

Group name: Ya Ha Tinda (*R. fescue*-H.wildrye

VEGE

EDMONTON ALBERTA

RESOU

Group name: Ya Ha Tinda (Sedge-Junegrass)

3 3286 52547940 4

LAYER	n	SPECIES	Plots					
			Avg		YW01		YW03	
			%	P	MC	Cv	Vg	Cv
5	1	POTERI	0.100	07.6	09	05		
6	2	OXYTSP	0.100	03.2	06	00		
3		ANEMMUL	0.100	03.1	02	03		
4	4	GEUMTRI	0.100	02.1	01	02		
5	5	OXYTMON	0.100	01.6	00	03		
6	6	CAMPROT	0.100	00.8	01	00		
7	7	CERAARV	0.100	00.5	00	00		
8	8	AGOSGLA	0.100	00.4	00	00		
9	9	POTEDIV	0.100	00.4	00	00		
10	10	VALEDIO	50.0	01.9	03			
11	11	ARTEFRI	50.0	01.4	02			
12	12	ZIGAEL	50.0	01.1	02			
13	13	SMILRAC	50.0	00.8	01			
14	14	ANDRCHA	50.0	00.8	01			
15	15	THALVEN	50.0	00.6	01			
16	16	VIOLADU	50.0	00.5	01			
17	17	ANTEPAR	50.0	00.3		00		
18	18	OXYTSE	50.0	00.1				
19	19	POTEGRA	50.0	00.1	00			
20	20	GALIBOR	50.0	00.1	00			
7	21	CARESPP	0.100	06.3	06	06		
22	22	KOELMAC	0.100	05.2	06	04		
23	23	POA PRA	0.100	03.3	02	04		
24	24	FESTSAX	0.100	02.9	01	04		
25	25	POA SEC	0.100	01.3	01	01		
26	26	ELYMINN	0.100	00.9	00	01		
27	27	AGROREP	50.0	01.0	02			
28	28	BROMINE	50.0	00.6	01			
29	29	DANTPAR	50.0	00.2		00		
9	30	LICHEN	0.100	06.8	01	12		